

Short communication

**Analysis of baseline by treatment interactions in a drug prevention and health promotion program for high school male athletes<sup>☆</sup>**

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**Abstract**

This paper investigates baseline by treatment interactions (BTI) of a randomized anabolic steroid prevention program delivered to high school football players. Baseline by treatment interactions occur when a participant's score on an outcome variable is associated with both their pretreatment standing on the outcome variable and the treatment itself. The program was delivered to 31 high school football teams (Control=16, Treatment=15) in Oregon and Washington over the course of 3 years (Total  $N=3207$ ). Although most interactions were nonsignificant, consistent baseline by treatment interactions were obtained for knowledge of the effects of steroid use and intentions to use steroids. Both of these interactions were beneficial in that they increased the effectiveness of the program for participants lower in knowledge and higher in intentions at baseline.

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<sup>☆</sup> For a full version of this paper go to <http://www.public.asu.edu/~davidpm/ripl/atlas/btifull.pdf>.

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## 1. Introduction

Baseline by treatment interactions (BTI) have been found in a variety of prevention studies, many of which have found differential program effects for low risk individuals as compared to their high risk counterparts (e.g., Flay et al., 1985; Wilson, Lipsey, & Derzon, 2003). Baseline by treatment interactions occur when the magnitude or direction of the effect of a treatment on an outcome variable depends on the individual's baseline standing on that variable. To use a prevention example, imagine a hypothetical program designed to reduce smoking in teenagers, where the outcome variable is the number of cigarettes smoked per day. If the group that received the intervention significantly reduced the number of cigarettes smoked compared to a control group, there would be a significant main effect of the treatment. However, if upon closer inspection of the treatment group it was found that heavier smokers reduced their smoking to a greater degree than lighter smokers, a baseline by treatment interaction would be present. That is, the effectiveness of the intervention on the number of cigarettes smoked would depend upon the number of cigarettes the individual smoked before participation in the intervention.

Baseline by treatment interactions are used to assess the potential differential effects of an intervention, which can be beneficial or harmful in nature, or represent ceiling or floor effects on outcomes. Using the smoking example, the greater reduction in smoking in the heavy smoking group compared to the light smoking group is a beneficial interaction because while both subgroups reduced their smoking, one group reduced it by a greater degree. In contrast, if one of the subgroups had increased the number of cigarettes smoked from baseline to post-test, a detrimental or iatrogenic interaction would be present. Numerous authors have discussed iatrogenic effects and the need for the investigation of the presence of these effects in prevention programs (e.g., Werch & Owen, 2002). Besides identifying any iatrogenic effects, another reason to investigate baseline by treatment interactions in prevention programs is to discover how specific subgroups are affected by the program, which may suggest changes to the content or implementation of the program such as tailoring the treatment to a particular subgroup's specific needs.

### 1.1. *The ATLAS program*

ATLAS is a prevention program aimed at preventing the use of athletic enhancing supplements and anabolic androgenic steroids (AAS) among high school football players (Goldberg et al., 1996; Goldberg et al., 2000). ATLAS focused on reducing AAS use by presenting nutrition and strength training programs as alternatives to AAS use. ATLAS is unlike most other drug prevention programs in that by promoting nutrition and strength training, ATLAS was able to offer direct alternatives to AAS use and other athletic enhancing substances (for more information on ATLAS, see Goldberg et al., 2000).

## 2. Methods

### 2.1. Participants

The participants in this study were 3207 male high school football players from Oregon and Washington separated into three cohorts. The mean age of the participants at baseline was 15.43 years, with 73.3% of the fathers and 67.9% of the mothers having had at least some college education, and the parental divorce rate was 33.54%. None of the demographic variables varied significantly across cohorts (all  $p$ -values  $>0.05$ ) except for age, which decreased from Cohort 1 to the later cohorts by several months, which was expected because players in later cohorts were new to the team and mostly freshmen and sophomores.

### 2.2. Measures

Three outcome variables, intentions to use AAS, nutrition behaviors, and strength training self-efficacy, were measured along with 12 potential program mediators, including knowledge of the effects of AAS use (for a complete list of potential mediators and the individual items that made up the scales and the reliabilities of the scales, see [MacKinnon et al., 2001](#)). The baseline measures were taken at the beginning of the fall football season. A post-test was taken at the end of the season and a 1-year follow-up was taken the following fall, with graduating seniors being tested in the spring before graduation.

### 2.3. Statistical analysis

For the 12 hypothesized mediators and the three outcome variables, ordinary least squares (OLS) regression was used with both the immediate post-test and the 1-year follow-up measurements as the dependent variable and the baseline measurement, group membership, and the interaction between baseline measurement and group membership as the predictors for each cohort. A second across cohorts OLS regression analysis investigated whether the interaction between baseline standing and group membership varied across cohort by probing the cohort by baseline by group three-way interaction. To adjust for the dependence among students at the same school, the same analyses were conducted a second time using random coefficients modeling with school membership as the clustering variable.

## 3. Results

Twenty significant two-way interactions out of ninety possible interactions were found. One outcome variable, intent to use AAS, and one program mediator, knowledge of the effects of AAS use, were the only two variables found to have significant baseline by treatment interactions that replicated across cohorts as shown in [Table 1](#). Analysis of the three-way interaction showed that the intent to use AAS interaction was not consistent across cohorts. The results of the random coefficients analyses were almost identical to the

Table 1  
OLS regression coefficient estimates, standard errors, and partial correlations for the two-way Baseline×Group interaction term and the three-way Baseline×Group×Cohort interaction term

Construct	Cohort 1		Cohort 2		Cohort 3		Three-way interaction	
	Post-test	1 year	Post-test	1 year	Post-test	1 year	Post-test	1 year
Intent to use AAS	−0.008	0.032	−0.153	−0.309**	−0.093	−0.328**	−0.077	−0.187**
	(0.046)	(0.062)	(0.081)	(0.101)	(0.091)	(0.103)	(0.041)	(0.051)
	<b>0.005</b>	<b>0.018</b>	<b>0.074</b>	<b>0.149</b>	<b>0.041</b>	<b>0.156</b>	<b>0.038</b>	<b>0.089</b>
Knowledge of AAS use	−0.223**	−0.235**	−0.223**	−0.033	−0.339**	−0.074	0.017	0.022
	(0.053)	(0.070)	(0.078)	(0.100)	(0.084)	(0.102)	(0.040)	(0.051)
	<b>0.109</b>	<b>0.113</b>	<b>0.111</b>	<b>0.016</b>	<b>0.159</b>	<b>0.036</b>	<b>0.008</b>	<b>0.010</b>

Standard errors are in parentheses. Partial correlations are in bold.

\*\*  $P<0.01$ .

regression analyses and are not presented. A full version of this study with the results of both analyses for all outcome and mediator variables is available at <http://www.public.asu.edu/~davidpm/ripl/atlas/btifull.pdf>.

4. Discussion

Overall, it appears that ATLAS does have at least one baseline by treatment interaction, knowledge of the effects of AAS use, and possibly a second BTI, intent to use AAS, based upon a student’s pre-intervention level of risk. For the knowledge variable, individuals who knew less about AAS prior to the program learned more from the program than those whose prior knowledge about AAS was greater. And, for individuals with a higher degree of intent before the program, ATLAS decreased their intentions to use AAS more than those with low intent to use AAS for later cohorts. Since the baseline by treatment interaction analysis did not reveal any adverse, iatrogenic effects, this study is then consistent with the idea that ATLAS, designed to be delivered in a team atmosphere, can be safely applied, regardless of the student athlete’s risk.

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